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Kodak
Professional Notes

For Registered Owners of:
Kodak Color, Industrial, and Professional Handbooks

KEYS TO COLOR PRINTING

Part V (VOLTAGE CONTROL)

SOME PHOTOGRAPHERS are actually surprised to learn that voltage fluctuations in their printer circuits are both common and frequent. They have a sort of an it-can't-happen-to-me attitude. The fact is, however, that voltage variations do exist. Some are characteristic of the time of day; others depend on the use of other electrical equipment in the immediate vicinity.

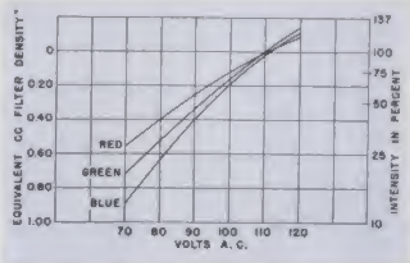
In order to measure the effect of light-intensity changes in voltage on a typical tungsten enlarger lamp, the following experiment was made. A variable transformer was placed in an enlarger-lamp circuit with an a-c voltmeter across the lamp terminals. This allowed manual variation of the voltage applied to the lamp and a measure of the *voltage at the lamp terminals.*

By means of a photoelectric photometer, the intensity of the light from the optical system of the enlarger was measured for its red, green, and blue components. The intensities of the three components of the light were measured at 10-volt increments from 70 to 120 volts. The results are shown in the accompanying graph. The curves are plotted so that 110 volts represent the zero point for the vertical scale (log intensity).

Inspection of these curves will show immediately that, with a decrease in voltage, not only does the total intensity fall off very rapidly, but also this effect is greatest with the blue component and least with the red.

Now, what does this mean in terms of practical color printing, such as with Kodak Color Print Material, Type C? Let's take some examples:

A good print has been made, for example, under the following conditions



*Density value of complementary Color Correction Filter which would produce the same effect on the respective primary light components.

and using separate red, green, and blue exposures: at 110 volts—red, 15 seconds; green, 20 seconds; blue, 12 seconds.

A second print made at 100 volts (a ten-volt decrease from normal) represents a decrease in log intensity (from the curves) of: red, –0.12; green, –0.15; blue, –0.20. A print made under these conditions will appear light and lacking in yellow.

Correction could be made by increasing the time of exposure for red, green, and blue by using the log-intensity differences as density units to calculate new exposure times. This calculation is readily performed by use of the Kodak Dye Transfer Dataguide. The new times become: red, 21 seconds; green, 29 seconds; blue, 21 seconds.

A second example might involve making the print exposure at 120 volts (10 volts over normal). From the graph, this is an increase in log intensity of the three components of: red, +0.10; green, +0.15; blue, +0.12. An uncorrected exposure would result in a print that is both too dark and excessively magenta. The corrected exposure calculated as described above would be: red, 12 seconds; green, 13 seconds; blue, 9 seconds.

For white-light printing using CC filters, it can be noted that the red, green, and blue components of the filtered white light still change with an increase or decrease in voltage. Corrections can be calculated by approximating the relative intensity losses or gains in terms of the nearest nominal values of CC filters that control each of the three colors of light—cyan, magenta, and yellow filters for red, green, and blue light, respectively.

Calculations such as the above can, admittedly, become tedious and are really unnecessary if some adequate form of voltage control is utilized.

There are two applicable forms of voltage controllers on the market. The first type is the constant-voltage transformer, sometimes called "voltage stabilizers" or "voltage regulators." This type of unit, when placed in the line between the source of power and the enlarger lamp, serves automatically to smooth out any fluctuations in the voltage. Even

Table of typical exposure changes entailed by a 10-volt change in lamp voltage when using the divided-exposure method

	Red Exposure (in sec.)	*Green Exposure (in sec.)*	*Blue Exposure (in sec.)*
Best print at 110 volts requires:	15	20	12
To match the above print when the voltage is 100 volts requires:	21	29	21
To match the above print when the voltage is 120 volts requires:	12	13	9

though the voltage varies anywhere between 95 and 130 volts, the output from the transformer will remain constant at 110 volts to within ±½%.

The other type of voltage controller consists of a manually adjustable variable transformer. Known by such names as

(Continued on page 8)

Gaseous Burst Agitation *–is it for you?*

WANTED: An agitation method for film which will give the uniformity and reproducibility of continuous agitation in a tray, be applicable to batch processing of many films at once, be automatic so that it does not require the full-time attention of the darkroom technician, and be reasonably economical in use.

FOUND: Gaseous burst agitation.

How It Works: Gaseous burst agitation consists in releasing "bursts" of gas at controlled intervals, simultaneously, through a myriad of small holes in a distributor at the bottom of the processing tank. This imparts a sharp displacement pulse to the entire volume of developer; and then, as the bubbles make their way to the surface, they provide a localized agitation around each small bubble. The multiplicity of bubbles and the random character of their paths to the surface give a good agitating action at the vertical surfaces of films hanging in the solution.

The Gas—Because of its widespread availability in pure form, its nontoxicity, and, most important, its inert chemical character, nitrogen is the most desirable gas to use in this agitation method. It is completely nonreactive with processing solutions.

Compressed air cannot be used as the agitator gas in developer solutions, since it contains a high percentage of oxygen. Compressed air can be used in stop, bleach, and wash baths, however, since they are not harmed by oxygen. The only consideration here is that the compressed air must be free of oil. This means that an oil-free air-compression system must be used.

Nitrogen is obtainable in compressed form in large cylindrical tanks about five feet high and one foot in diameter. These are obtainable from local suppliers of compressed gases who can be located by consulting the classified telephone directory under such categories as: "Gas, Compressed" or "Oxygen." Commercial-grade nitrogen is usually satisfactory for photographic purposes. A purified grade, designated "Water-pumped nitrogen, yellow-band N_2," is available at a slightly higher cost and desirable under certain conditions.

The cost of nitrogen is about $5.00 per cylinder (depending on local conditions), plus, in some cases, a refundable deposit on the cylinder. Experience shows that one such cylinder operating at an output pressure of 15 pounds per square inch, with a burst duration of 1 second and an interval of 10 seconds between bursts, will feed a gas distributor in a 3½-gallon tank for 7 hours a day for 4 or 5 days. Longer intervals between bursts naturally extend the time that gas is available from a cylinder.

Pressure-Control Valve—Nitrogen in cylinders is under an initial pressure of 2,000 pounds per square inch. It is therefore necessary to reduce this pressure to the 15 pounds per square inch at which it is to be released in a 3½-gallon tank. For this purpose, a gas-pressure-control valve can be obtained from gas suppliers. This unit provides a pressure reducer valve and two pressure gauges—one on the tank gives an indication of the amount of gas remaining in the tank, and one on the line side of the valve allows adjustment of the output pressure to any desired level.

Burst Timer and Valve—To provide automatic control of the flow of nitrogen to the gas distributor in the tank, an

electrically operated solenoid shutoff valve is used in the line between the pressure-reducing valve and the distributor. To reduce the volume of gas in the line between the gas distributor and the solenoid valve, it is desirable to locate this valve as close to the distributor as possible.

This valve is simply an open-or-shut control which is actuated by an electric current; i.e., when the control current is on, the valve is open; when the current is off, the valve is closed. To provide these operating currents at the proper intervals and of the proper duration, an electric timer is required. The timer must provide for control of the length of the current pulses (valve open time), and for control of the length of time between pulses. For processing Kodak Color Print Material, Type C, the Kodak Intermittent Gaseous Burst Valve (Model 12) provides the burst time and interval which is recommended for this material. The timer and gas valve are available as an integral unit.

If several tanks are being agitated by nitrogen burst, they can all be connected to the same solenoid valve. However, in this type of arrangement, some tanks may receive more agitation than others. The agitation in all of the tanks can be evened out by placing a "turn cock" in the line to each tank to allow for adjustment of the flow to each distributor.

The Gas Distributor or Agitator—In order to provide uniform distribution of the bubbles of gas across a horizontal cross section of the tank, several branch pipes are connected by a header at one end. On most distributors, the other end of each individual pipe is stopped with a removable plug to allow for frequent internal cleaning. There are several materials which can be used for the distributor, but the most satisfactory ones are thin-walled, stainless-steel tubing and various plastic materials, such as unplasticized polyvinyl chloride.

The Kodak Gas Distributor (for Kodak Hard Rubber Tank, 8 x 10) is made of plastic and provides an ideal gas distribution pattern in most standard 3½-gallon tanks. The pattern of bubbles as they emerge from the surface is quite uniform, with no points of significant concentration and with no areas devoid of agitation. This distributor is designed for use with the Kodak Processing Basket (for color print material in sheets). For film processing use, it is placed in the bottom of the tank and left there.

It is important that the gas distributor be level and centered in the tank. After it is placed in position, the bubble pattern should be noted carefully. If it is not uniform over the entire surface, either the distributor will need to be leveled in the tank or the tank itself will need to be leveled until the agitation pattern is homogeneous over the entire surface of the solution.

Operation—In the gaseous burst agitation system, the aim should be to match or improve the results obtainable by processing the film by hand in accordance with recommended procedures. The variables which can be adjusted to achieve this end are burst duration, interval between bursts, and total time of immersion of the film in the bath.

Burst Duration—The length of the gas burst has been found to be variable within the rather narrow range of one-half to two seconds. A shorter burst may be ineffective, and a longer burst results in channelization of the bubbles, with consequent nonuniformity and possible trouble from foaming the developer over the top of the tank.

Burst Intervals—The interval between bursts has been found to be effectively variable between 10 and 20 seconds for black-and-white film. (For color-film

recommendations, see next column.) Ten-second intervals will give greater agitation and better uniformity than 20-second intervals. This will increase contrast and density, and will suggest the need for shortened developing time.

A balance may also be sought here between the amount of agitation necessary for the desired uniformity and the economy of gas consumption. In other words, one should use the longest interval possible to achieve the desired degree of uniformity.

Processing Time—Desired negative quality can be obtained by selecting a suitable combination of the variable factors of burst duration, burst interval, and total time. Experiments at Kodak laboratories indicate that a 1-second burst at 20-second intervals will give excellent uniformity when using any of the popular Kodak panchromatic or orthochromatic films.

The 20-second-interval cycle will closely approximate the emulsion speed and contrast obtained by using the same development time as recommended for intermittent hand agitation in tanks. These values should be regarded as a departure point for making tests to ascertain the best combination of conditions for a given operation.

If it is desired to modify the process to speed it up or to achieve an even higher level of uniformity, it is possible to decrease the burst interval. For example, if the burst interval is shortened from 20 seconds to 10 seconds, the processing time in Kodak Developer DK-50 will be shortened by approximately 10 percent and, in the less active form of DK-50 (diluted 1:1), the processing time will be shortened by about 25 percent. Depending on the operating conditions selected and the aim point in negative quality, other developers will exhibit differing reactions, and the optimum must be derived by some experimentation under actual operating conditions. In any event, no total immersion time of less than 4 minutes should be considered with the more active developers, such as Kodak Developer DK-60a or DK-50. If 4 minutes produces more contrast than is desired, it will be better to lengthen the interval between bursts to lower the agitation and keep the total time above 4 minutes.

Processing of Color Films—In a 3½-gallon tank using a Kodak Gas Distributor, Kodak Ektacolor and Ektachrome films can be satisfactorily processed in the presently recommended processing times. Fourteen 8 by 10-inch films can be processed at one time in a Kodak Developing Hanger Rack No. 4 and a burst duration of 1 second is recommended every 60 seconds. This recommendation should be used as a starting guide, and alterations should be made in the interval and burst duration if the results indicate that a change is necessary or desirable.

Is It for You? Tests made on the uniformity of processing in tanks equipped for such agitation have shown that it can match or even exceed the uniformity obtained when a skilled operator processes the material by hand.

SOURCE OF TRANSLUCENT PRINTING PILLOWS

A technique for the reflex copying of bound books, using a translucent Vinylite air pillow, is described in "How to Use Kodagraph Reproduction Materials," p. 27. Such air pillows, it is understood, may be purchased from F. G. Ludwig, Inc., Old Saybrook, Connecticut, owners of patent 2,591,449.

TENTING TONIGHT?

Photography by Rick Warner, Kodak Professional Studio

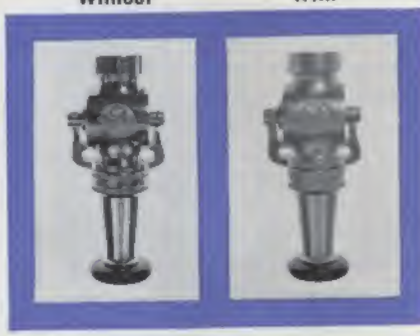
ANY commercial photographer "worth his salt" well knows the technique and advantages of tenting shiny metal objects. But we'd like to add what may be a new thought to the process by suggesting the use of Matte Kodapak I Sheet instead of the customary white paper or cardboard. The advantage of the acetate is that it is sufficiently translucent so that "raw" light can shine through it and become beautifully diffused in the process.

Thus, the placement of the lights around a matte acetate tent is far less troublesome than if relatively opaque white paper were used. This means that any metal object, such as tableware, can be lighted in the conventional way and *with* regard for the delicate contours which you may want to bring out. In other words, paper will still do the job for a flat metal surface, but our photographers have found it's hard to beat the matte acetate both for ease in establishing the best lighting and for the visual impression of delicate roundness of curved metal surfaces.

During. You will also be interested to note that a light box was used to eliminate background shadows.

The particular acetate we suggest for this purpose is .010" Matte Kodapak I Sheet. It is available in continuous rolls

Without **With**



up to 40" in width, as well as cut-to-size sheets from the following suppliers (*not* available directly from the Eastman Kodak Company).

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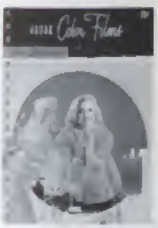
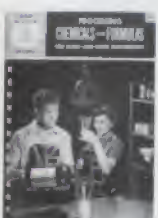


Kodak Color Films—New Second Edition. A component of the Kodak Color Handbook. Data Sheets completely overhauled: New pages for the higher-speed, higher-definition Kodak Ektachrome Films designed for Process E-2 and the new negative films, Kodak Ektacolor Film, Type S, and dual-purpose Kodacolor Film. Material on color balance and speed expanded into a new section on critical use of color films, illustrated in color. This is *must* reading. Should improve understanding of fundamental considerations in use of color films. New illustrations. 72 pages, $.75. You'll want to replace any printing of the First Edition.

Kodak Films—New Seventh Edition. A component of the Kodak Reference Handbook, Volume I. Up-to-date information and data sheets on Kodak black-and-white films, such as Tri-X, Verichrome Pan, Plus-X, Panatomic-X, and Royal Ortho Sheet Film. A new section on definition explains relationships between graininess, sharpness, and resolving power. Illustrated! 68 pages, $.50.



Processing Chemicals and Formulas—Revised Fifth Edition. A component of the Kodak Reference Handbook, Volume II. Latest information and techniques on processing, formulas, and Kodak prepared chemicals. Processing data have been modified to fit improved characteristics of new Kodak black-and-white films. Illustrated. 68 pages, $.50.

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VOLTAGE CONTROL

(Continued from page 2)

"variable-voltage controls," "Variac," "Powerstat," and "Autoformers," these differ from the first type in that they do not automatically adjust their output voltage when the input changes. Their output changes commensurately with a change in input, but the control knob allows manual adjustment back to the aim-point value of voltage. In general, this type of controller is cheaper than the constant-voltage type and provides the additional facility of allowing voltages other than 110 or 115 to be used if desired. Their major disadvantage is that they are not self-regulating. An ideal system consists of a voltage stabilizer in series with a variable-voltage controller. This allows selection of the voltage over a wide range and, at the same time, assures that it will remain constant after it has been set.

If a variable transformer is used to adjust the lamp voltage, a voltmeter must be provided, if one is not built into the controller, to allow the voltage to be checked and "zeroed" before each exposure. This voltmeter may have its needle and a mark at the 110-volt point on the scale painted with luminous paint. Thus, even in the dark, it is easy to line up the two spots to bring the voltage into line.

The selection of either type of controller will be governed by the wattage rating of the enlarger lamp. A 100-watt enlarger lamp will require at least a 100-watt controller; and a 250-watt lamp, a 250-watt controller, etc. The controller may have an excess of capacity if needed. For example, a 500-watt controller can be used quite satisfactorily with a 100-watt lamp, but the lamp cannot have a larger wattage rating than the control unit, or instability and ultimate failure of the controller will result.

Radio-equipment supply houses are able to supply either type of controller that you might desire, and will also be in a position to help with the selection of a unit of appropriate capacity.

Sales Service Division

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